CAPTAIN'S COVE & LI TUNGSTEN
CITY OF GLEN COVE, NASSAU COUNTY, NEW YORK

RADIATION MONITORING PLAN

PREPARED FOR:

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LIST OF ACRONYMS

cpm	Counts per Minute
EPA	United States Environmental Protection Agency
FS	Feasibility Study
HPFT	Health Physics Field Technician
HPSO	Health Physics Safety Officer
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentrations
m/s	Meters per Second
NaI	Sodium Iodide
NYSDEC	New York State Department of Environmental Conservation
pCi/g	Picocuries per Gram
RMP	Radiation Monitoring Plan
RI	Remedial Investigation
SMP	Site Management Plan

1.0 INTRODUCTION

This Radiation Monitoring Plan (RMP) has been prepared in accordance with the *Multi-Agency Radiation Survey and Site Investigation Manual, Revision 1* (EPA, August 2000 and June 2001 updates) (MARSSIM), and with the Site Management Plans (SMP) for the Captain's Cove and Li Tungsten Sites in Glen Cove, NY: *Site Management Plan, Captains Cove Site* (Dvirka and Bartilucci, June 2010) and *Site Management Plan for Li Tungsten Site, Glen Cove, NY* (Dvirka and Bartilucci, May 2012). These SMPs provide additional background information, site descriptions, redevelopment plans and soil management specifications for each of the Sites.

This RMP will be implemented during work at the Captain's Cove and Li Tungsten Sites by the Contractor's Health Physics Field Technician (HPFT) in coordination with the Consultant's Field Engineer. All parties entering the site, including representatives of the United States Environmental Protection Agency (EPA), New York State Department of Environmental Conservation (NYSDEC) and or the City of Glen Cove, are required to comply with this RMP. The RMP may be revised based upon radiation levels measured in the field after earthwork or excavation activities have been initiated. Any proposed changes must be reviewed and approved by the City's Consultant Health Physics Safety Officer (HPSO) (or their designee) and the NYSDEC.

The NYSDEC will be notified at a minimum of 15 days prior to earthwork or excavation activities.

1.1 Purpose and Scope

In accordance with past remedial efforts summarized in the SMPs, radioactive soils were previously removed from areas on and/or adjacent to the Captain's Cove and Li Tungsten Sites and the excavations were backfilled with clean soil. The purpose of this RMP is to address radiation monitoring activities to be performed during pre-construction and construction activities (e.g., test pits, geotechnical borings, subsurface soil sampling, excavation, etc.) at both Sites. Specifically, soil excavated during redevelopment activities will be monitored for radiation to:

- Segregate soil/waste that may contain radioactive contamination (if any); and
- Protect onsite workers from potential exposure to dangerous levels of radiation.

Proposed redevelopment plans for the Captain's Cove and Li Tungsten Sites, which are both currently vacant, include the construction of a mixed-use waterfront development that combines residential, commercial, cultural, retail, recreational and entertainment spaces. Preliminary plans have been developed for the Sites; however redevelopment may occur in phases over several years. Areas of the Sites that will not be subject to earthwork or excavation prior to redevelopment and during the initial phases of redevelopment shall be subject to the engineering and institutional controls specified in the SMPs.

2.0 RADIATION MONITORING PLAN

The monitoring protocol specified in subsequent sections includes the identification of minimum qualifications for the Contractor's HPFT, selection of appropriate radiation monitoring instruments, instrument calibration, radiation monitoring methodology and establishing background radiation levels at both the Captain's Cove and Li Tungsten Sites. Any radioactive waste identified as a result of monitoring will be segregated and managed by the Contractor as described in the SMPs.

2.1 Health Physics Field Technician Qualifications

Radiation monitoring will be performed by the Contractor's HPFT. The Contractor's HPFT qualifications will be reviewed by the Consultant and the NYSDEC. At a minimum, the candidate HPFT will have successfully completed Radiation Worker Training, have 2 years of experience performing field gamma radiation monitoring, have experience with the monitoring instruments specified in Section 2.2 (including routine operation and performing instrument field checks), have demonstrated experience in measuring site background radiation levels and have experience with the collection, handling and shipment of samples for radiological analyses.

2.2 Selection of Radiation Monitoring Instrument

The selection of radiation monitoring equipment was based on the type of radiation in the Li Tungsten mill tailings previously located on and/or adjacent to the Sites. The mill tailings, which contained uranium and thorium, were generated during mineral processing of tungsten ores at the Li Tungsten Site. The tailings also contained daughter products, including isotopes of thorium, uranium, radium, and several other products of the natural decay chains. These radioactive elements produce a mixture of alpha, beta, and gamma radiation. Although alpha and beta radiations are produced by the radionuclides in soil that was present on and/or adjacent to the Sites, these radiations have low penetrating ability, and they are shielded by the first centimeter of soil. This low penetrating ability for alpha and beta cause these radiations to be very difficult to detect by direct measurement. Accordingly, radiation monitoring equipment capable of detecting gamma radiation (a highly penetrating radiation) is specified. For this purpose, a Ludlum™ Model 2221 count-rate meter and scaler (or equivalent) equipped with a 100 cm^3 (2" x 2") sodium iodide (NaI) detector is specified.

2.3 Radiation Instrument Calibration and Operation

The radiation rate meter/scaler will be calibrated by the supplier in accordance with the instrument manufacturer's specifications. A source traceable to the National Institute for Standards and Technology (NIST) will be used for calibration. This calibration, in combination with manufacturer developed energy response curves, will be used to characterize instrument response. The response of the meter will be evaluated with a check source daily before and after each survey. Source check results will be recorded in the field log book. All supplier calibration records and source check results will be maintained onsite throughout the duration of

redevelopment activities. During monitoring, the count-rate meter will be operated in the audio mode to aid in detecting radiation count rate changes above 2-times background.

2.4 Establishing Site Background

Based on the results of the Remedial investigation/Feasibility Study (RI/FS), and the EPA Focused Feasibility Study (FFS), a background radiation level in counts per minute (cpm) was previously developed for the site. However, since that background determination was performed over 10 years ago, and because the instrumentation, while similar, may have been set up differently, the following gamma survey for background determination will be conducted prior to soil removal:

At an unaffected site with geological properties and soil types similar to LI Tungsten Site and Captain's Cove Site:

- 20 locations, spread over an area of at least 1 acre
- 1 minute static count at each location using a 2" x 2" NaI detector at ~ 3" from ground surface
- Determine the mean and the range of the 20 locations
- Example: Range = 3,500 - 9,000 cpm; mean = 5,000 cpm; 2 x mean = 10,000 cpm

Descriptions of the soil types and the 1-minute gamma counts will be recorded in the field log book.

2.5 Radiation Monitoring Methodology

The following radiation monitoring protocol was developed to identify radioactive material that may be encountered during pre-construction and construction activities. The monitoring protocol described below was designed to effectively detect gamma radiation to a depth of approximately 6 inches below the top of the surface being monitored. Based on this assumption, the monitoring will be performed on two-foot lifts of soil and will result in a monitored volume percent of approximately 25 percent. Although the entire surface of the Captain's Cove Site had been monitored extensively for radioactivity by the NYSDEC in 1997 and Roux Associates during the RI/FS completed during 1998, monitoring should begin at land surface to verify the conditions in the top two feet.

Radiation monitoring will entail scanning with the NaI detector and the count-rate meter detector across the floor of the excavation after each two-foot lift of material is excavated. If survey at the floor of the excavation is not practical (e.g., narrow trench or core samples), then the soil can be surveyed after removal. If removed soil is surveyed, it must be spread to a depth of 2 feet or less. During monitoring, the detector will be held approximately 3 inches or less above the surface being scanned. The detector will be moved over the surface being scanned at a rate not to exceed approximately 0.5 meters per second (m/s). This scan rate will allow the collection of a reasonable number of counts per scan. If count rates exceed 2-times background (as developed in 2.4.1, above), then the provisions specified in the SMPs will be implemented. In general, the SMPs require that excavated material that exceeds radiological screening criteria shall be stockpiled separately and the NYSDEC shall be notified. In addition, the excavated material shall be sampled and analyzed in accordance with Section

2.6 below. The location, including global positioning system (GPS) coordinates, of the hot spot and the maximum and minimum count rates observed (rounded to the nearest 100 cpm) will be recorded in the bound field notebook. Hot spot locations will be marked with paint, flags, or other marker. A general description of the material that was scanned (e.g., sand clay, peat, waste, etc.) will also be recorded.

Radiation levels measured up to two times the Site background is not considered to be a hazard. Radiation measurements in excess of approximately 2-times background will result in controlled disposition of the soil; however, it is not expected to be at a level that will be hazardous to the onsite workers. Note that past surveys of excavations onsite have not detected levels above two times background. As a protective measure against radiation dose to onsite workers, radioactivity above 1 mrem/hr (cpm equivalent to be calculated after instrument calibration) will be considered a potential radiation worker dose risk. Soil that exhibits readings above background but below the threshold for radiation worker dose risk will be handled as described in the SMPs, as there is no significant exposure risk at these levels.

2.6 Soil Sampling and Radiological Analysis

For any soil that is identified as exceeding the criteria of two times the Site background, a minimum of one sample of at least 400 grams shall be taken per stockpile, where the individual stockpile does not exceed 500 cubic yards. Samples shall be analyzed by gamma spectroscopy using Method EML-HASL-300 or equivalent. The spectroscopy should be specified to identify gamma emitting radionuclides associated with the uranium and thorium decay chains. The count times, sample sizes, and geometry should be able to produce Minimum Detectable Concentrations (MDC) of 0.1 picocuries per gram (pCi/g) for Ac-228, Pb-212, Bi-212, Tl-208, Ra-226/U-235, Pb-214, and Bi-214. For U-235, the MDC should be 1 pCi/g or better, and for Pa-234m, the MDC should be 10 pCi/g. Samples to be analyzed for radionuclides shall be dried samples and will be analyzed before activities of the Ra-226 and its daughter products have returned to equilibrium. If there are indications of readings in excavations that exceed the criteria of two times background, then confirmation sampling and analysis will be performed in accordance with NYSDEC guidance in DER-10 (May 2010).

Confirmation samples shall be collected in excavations to document any contamination that remains in place in accordance with the SMPs. Confirmation samples shall be analyzed by gamma spectroscopy using Method EML-HASL-300, or equivalent, to identify gamma emitting radionuclides associated with uranium and thorium decay chains.

3.0 REFERENCES

Dvirka and Bartilucci, 2010. *Site Management Plan, Captains Cove Site*, June 2010.

Dvirka and Bartilucci, 2012. *Site Management Plan for Li Tungsten Site, Glen Cove, NY*, May 2012.

EPA, 2000 and 2001. *Multi-Agency Radiation Survey and Site Investigation Manual, Revision 1*, August 2000 and June 2001 updates.